FSIS Food Safety Review

VOLUME 2 • NUMBER 1 • WINTER 1992

FSIS Proposes To Change Food Labels

Agency Studies Perceptions Of Public

FOOD SAFETY & INSPECTION SERVICE UNITED STATES DEPARTMENT OF AGRICULTURE

Food Science and the Public

Government agencies, including the Food Safety and Inspection Service, have a distinct role in helping the American public learn facts about the safety and wholesomeness of the food they eat. Because FSIS is responsible for inspection of meat and poultry and the accuracy of labels on those products, we have unique access to data and applied research directly related to food safety.

In recent years, FSIS has seen the public become alarmed about food because of the way in which some information has been presented. Too often, scientists have attempted to honestly convey scientific facts to the media and have watched their evidence condensed or misinterpreted by communicators to the point where it was almost unrecognizable.

Unfortunately, many people have become skeptical of much available information about food—and they may distrust both scientists and the media. No one wants this result.

At FSIS, we believe one of the solutions is to enhance media and public understanding of the scientific process. We also believe food science and public health professionals will need to enhance their understanding of communication, which is a science as well as an art.

Government cannot develop regulations without science or pursue scientific solutions in a vacuum. We are aware of the long history of how communication of science has influenced public health and vice versa.

The third issue of *FSIS Food Safety Review* will show how the Food Safety and Inspection Service is using science and communication guidelines in developing its proposal for food label reform. One article zeroes in on communication principles helpful to those in government and in science. We also report on a survey about what consumers really do know about food safety.

Other articles preview a new process using ozone gas to disinfect chiller water during poultry slaughter, and research into the use of *Escherichia coli* to indicate the presence of foodborne pathogens in food.

We trust you are finding our new *FSIS Food Safety Review* informative and helpful as you work with us to provide Americans with a safe and wholesome food supply—-and to communicate effectively.

David B. Schmidt, Director
Information and Legislative Affairs

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FSIS Food Safety Review is published by USDA's Food Safety and Inspection Service, the agency charged with ensuring the safety, wholesomeness and proper labeling of the nation's meat and poultry supply. The purpose of the magazine is to inform food science and public health professionals of current science-based initiatives to protect the public health.

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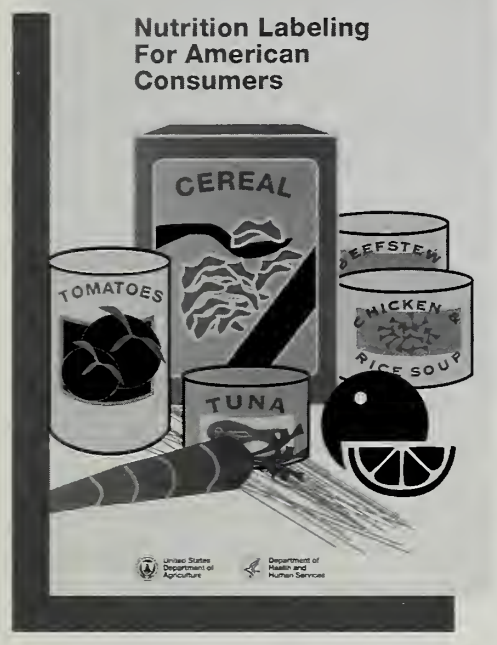


Bush Administration Acts on Nutrition Labeling, Education

by Sharin Sachs, BS, and
Dale Blumenthal, MA

In a move that highlights the link between science, communication and public health, the U.S. Department of Agriculture and the Department of Health and Human Services (DHHS) are advancing towards one set of consistent requirements for nutrition labeling of all foods and are participating in a broad coalition on nutrition labeling information and education.

The two agencies with oversight of food safety and labeling announced their plans for a sweeping reform of food labeling at a joint press conference on Nov. 6, 1991. USDA Deputy Secretary Ann Veneman remarked that the Bush administration's actions "will take the mystery out of food labels and help consumers understand" nutrition information. Veneman also expressed the hope that Americans will use the information "to adhere to the Dietary Guidelines for Americans and to select foods that fit into a total, healthful diet." The Dietary Guidelines were developed jointly by USDA and DHHS.

At a Glance

The USDA Food Safety and Inspection Service (FSIS) proposed a mandatory nutrition labeling system for processed meat and poultry products, and the DHHS Food and Drug Administration (FDA) proposed a mandatory nutrition labeling program for other processed foods.

FSIS proposed a voluntary nutrition labeling program for raw, single-ingredient meat and poultry products such as boneless chicken breasts. FDA finalized a voluntary nutrition labeling program for raw fruits, vegetables and seafood. Both agencies signaled their intent to survey raw foods in the marketplace, to report to Congress on the extent of voluntary nutrition labeling, and to implement mandatory nutrition labeling for raw foods after 1995 if the marketplace is not responsive.

The proposals of the two agencies distinguished between nutrition information and nutrition claims. A nutrition claim on labeling makes a claim about the presence, absence or amount of a specific nutrient; for example, "low-fat," "sugar-free," "X calories per serving." Food companies use nutrition claims to provide information, and also to compete with similar products in the marketplace. Both agencies in general proposed more stringent procedures for label disclosure for any product about which a nutritional claim is made.

The two agencies proposed that certain brand names using descriptions ("healthy," "light," etc.) be considered as "implied" nutrition claims under certain circumstances and only allowed if they meet the new definitions for the terms.

DHHS Secretary Louis Sullivan and USDA Deputy Secretary Ann Veneman stress the important link between accurate food labels and nutrition.

Under the proposal, labeling would be required for processed meat and poultry products. Raw meat and poultry would be subject to a voluntary system.

Percent of Daily Value

Under both FDA and USDA proposals, consumers would begin to see a new term on nutrition labeling — "Percent of Daily Value." It would represent several technical terms used by nutritionists and regulators and enable consumers to compare nutritional information on different products. FSIS and FDA have also proposed to replace the definition for U.S. Recommended Daily Allowances (RDAs) to include Reference Daily Intakes (RDIs) and Daily Reference Values (DRVs). RDIs would enable comparisons of protein, vitamin and mineral contents of foods. DRVs would enable comparisons of eight other food components—total fat, saturated fatty acids, unsaturated fatty acids, cholesterol, carbohydrate, fiber, sodium and potassium.

The Next Step

As the FSIS *Food Safety Review* went to press, the public comment period on the regulatory documents of both agencies was set to close Feb. 25. FDA and FSIS plan final regulations for November 1992, with marketplace implementation for most provisions by May 1993. FDA plans to issue a proposal on the most useful format for nutrition labeling in the spring of 1992, after conducting research studies to determine what label format is most useful and understandable to consumers.

To use the nutrition information on food labels, consumers will first have to understand it. Therefore, USDA and DHHS intend to participate in a long-term effort with trade associations, health and professional organizations, consumer organizations and organizations already formed to deal with nutrition label education. Groups including the American Heart Association, Food Marketing Institute, National Food Processors Association, American Dietetic Association and International Food Information Council are among those expected to play a key role in the new coalition on labeling information and education. The coalition will deal with the educational issues of understanding the nutrition label — by itself a major task — and then using the label information to make dietary choices. By initiating concerted planning early on, it is hoped all groups can be more effective in what has been described as "a 30-year educational project."

USDA Proposal

As a congressman, USDA Secretary Edward Madigan was a key architect of the 1990 Nutrition Labeling and Education Act (NLEA), which requires nutrition labeling for most FDA-regulated foods but does not affect meat and poultry products. When he reached USDA, Madigan directed FSIS to pursue nutrition labeling requirements for meat and poultry products that would be in harmony with those for other foods. FSIS was already moving in that direction under the leadership of its administrator and Assistant Secretary Jo Ann Smith, yet Madigan's commitment was key to reaching the November 1991 milestone of proposal publication. Secretary Madigan is concerned that all Americans, especially children in difficult economic circumstances, have access to adequate nutrition information and education.

Following are details of the FSIS proposal and a description of some of the issues likely to affect the final regulations.

For Processed Foods

The FSIS proposal would require nutrition information on about 500,000 labels of meat and poultry products prepared in USDA-inspected plants—everything from hot dogs and ham to beef burritos and chicken pot pies.

For Raw Meat and Poultry

A voluntary system would be set up under the proposal for nutrition labeling of raw, single-ingredient products, such as chicken breasts and beef roasts. The FDA's voluntary system for raw produce and raw seafood will be final in 1992. Both FSIS and FDA propose mandatory nutrition labeling for raw foods if the marketplace is not responsive, and FSIS plans to report on that issue in 1995. FDA will issue its first report in 1993.

Alternatives to Labeling

The FSIS proposal would allow posters, shelf labels, inserts and other alternatives to product labeling for certain meat and

poultry products (unless nutritional claims are made on labeling, in which case nutrition labeling would be required). These other means of informing consumers could be used for:

- raw, single-ingredient products in the voluntary program;
- very small packages (1/2 ounce or less) of processed foods under the mandatory program; and
- large institutional-size packages.

The alternatives would have to include the same information that would otherwise be on the nutrition label. Under the FSIS proposal, meat and poultry products intended for further processing would be exempt from all nutrition labeling; for example, cooked sausage crumbles for burritos.

Nutritional Value

FSIS has proposed to require nutrient information on an "as packaged" basis for chili, hot dogs and other processed meat and poultry products under the mandatory program, consistent with FDA requirements for other processed foods. "As packaged" labeling would list information about the nutrients in a serving of the food as it is purchased, without further consumer preparation.

Raw, single-ingredient meat and poultry products under the voluntary program could declare nutrients on the basis of either "as packaged" or "as consumed." (The FDA final rule requires fresh produce to list nutrients "as packaged," and seafood to list them "as consumed.")

For "as consumed" listings, FSIS intends that no additional ingredients such as flour, fat, or salt will have been added, as these could alter the nutritional profile. FSIS also intends that a common cooking method such as baking or oven roasting would have been used.

Serving Sizes

Developing tentative standardized serving sizes for nutrition labeling was one of the most complex aspects of proposal development for both FSIS and FDA.

FSIS and FDA agreed on the need for standardized serving sizes as the basis for reporting nutrient values, for comparing similar products and for understanding nutritional descriptors. Therefore, they opened the issue to public comment, held a public meeting on serving size and ultimately formed a joint task force to develop standard serving sizes.

Although the National Academy of Sciences had recommended basing standard serving sizes on dietary guidance recommendations, the NLEA required FDA to base serving sizes on consumption data. Ultimately deciding that uniform requirements for all foods should be the overriding consideration, the agencies agreed to base standard serving sizes for processed foods on actual consumption.

Processed foods. FDA and FSIS proposed 131 broad categories of processed foods and established for each category "reference amounts customarily consumed per eating occasion" by the general population. They proposed to define a serving as the amount of food consumed during a meal or snack by a person 4 years of age or older. Meat products make up 23 of the 131 product categories, and poultry products comprise 22 categories. Separate reference amounts are listed for infant and toddler foods.

Most proposed reference amounts are defined in grams; for example, 140 grams of barbecued beef in sauce. However, a few proposed reference amounts are listed in other terms; for example, a reference serving of chicken noodle soup would be one cup.

For practical reasons, FSIS and FDA agreed to consider meal-type products marketed as one serving to declare nutrients on the basis of the entire product.

Conversions. The agencies have proposed procedures for converting reference amounts into actual servings per container. (The proposals are intended to provide consumers with usable nutrient information — not to require repackaging of all foods.) The FSIS proposal by reference incorporates FDA's proposed procedures. The nutrient profile on the label for a serving of the product will be adjusted to match the actual serving, not the reference amount.

For products packaged in units or pieces, such as hot dogs, FSIS and FDA proposed "whole number" serving sizes closest to the reference serving size. For

Backing Up the Nutrition Label

Under the FSIS proposal, all manufacturers will be responsible for the accuracy of the nutrition label. They will have to keep records to support the nutritional values on the label (whether from a reference such as *Handbook 8* or laboratory analysis) and make this information available to regulators.

This would be true of raw, single-ingredient products such as raw chicken breasts, as well as processed products such as beef stew.

Companies making nutrition claims on meat or poultry products would be expected to meet a more stringent verification standard. They would have to maintain "partial quality control programs," including testing, to show their ongoing control over the accuracy of nutrition labeling.

FSIS has proposed to maintain its existing parameters for compliance, which it believes are consistent with the state of science and feasible enforcement. If a product contained less than 80 percent of the labeled amount of a desirable nutrient, or more than 120 percent of the labeled amount of a less desirable nutrient, FSIS would notify the manufacturer and expect correction within 30 days. If necessary, FSIS could withdraw approval of the label to ensure compliance (without label approval, products could not be sold).

Nutrient Databases. A basic question about nutrition labeling is, "What is the source of the nutrition information on the label?"

If no nutrition claim is made on labeling, the FSIS proposal would allow manufacturers to use either databases or analyses.

FSIS expects comments on the use of databases for meat and poultry products. FSIS is hopeful that manufacturers who wish to develop nutrient databases to satisfy regulatory requirements will do so in concert.

example, the reference serving size for hot dogs and other products in the "luncheon meat" category is 55 grams. If a package of full-size hot dogs contained hot dogs weighing 65 grams each, one serving would still equal one hot dog. However, for cocktail franks weighing 30 grams each, one serving would equal two cocktail franks (60 grams). In both cases, the nutrient profile per serving would be based on the actual weight of the serving — 65 grams for one full-size hot dog or 60 grams for two cocktail franks — not the reference amount of 55 grams.

Meaningful terms. The agencies have proposed that the food labels list serving size in both common household measurements (cup, tablespoon, teaspoon, pieces, slices, or, if unavoidable, ounces) and metric terms (grams). Nutrition labeling is one of the arenas where the mandatory move to a metric system will be most evident in the near future. However, the agencies acknowledge that many consumers are not yet familiar with metric terms and therefore propose a dual system.

Raw products. FSIS has proposed a uniform serving size of three ounces (recommended by current USDA/DHHS Dietary Guidelines and by the National Cholesterol Education Project), on a cooked basis, for raw, single-ingredient meat and poultry products covered in the voluntary program. (FDA has finalized a serving size of three ounces, cooked, for raw seafood under the voluntary program.)

For the voluntary program, the agency has also proposed a list of 45 common cuts of meat and poultry, drawing on USDA nutritional studies and "Nutri-Facts" programs established by the Food Marketing Institute in cooperation with (for meat) the National Livestock and Meat Board and the American Meat Institute and (for poultry) the National Broiler Council and the National Turkey Federation.

The most common cuts of meat and poultry listed in the final regulations will be used in determining marketplace responsiveness to voluntary nutrition labeling for raw, single-ingredient meat and poultry products (just as the FDA-defined list of other raw foods will be used by that agency in determining compliance with its voluntary program now in effect).

Descriptors

FSIS has proposed adopting several FDA definitions for "descriptors" such as "free," "low," "light" or "lite," "reduced," "less," "fewer," "source of," "high" and "percent fat-free." (FDA is required by the NLEA to define certain descriptors.) These terms, for example, "low-fat," are useful for characterizing a product's content of specific nutrients such as fat, sodium and cholesterol. Descriptors are essentially nutritional claims. The NLEA permits the use of only FDA-approved descriptors and requires FDA to adopt a petition process for the review and approval of others. FSIS also plans to initiate a petition process for reviewing descriptors and implied claims in brand names.

FSIS proposed establishing the unique terms "lean" and "extra lean" for meat and poultry products. The agency believes the use of these terms would enable consumers to make meaningful comparisons about fat content in meat and poultry products (whether raw or processed) that might not satisfy requirements for the "low-fat" descriptor. The terms also would provide incentives to industry to produce leaner meat and poultry products.

The descriptor "lean" would refer to cooked meat or poultry with less than 10.5 grams of fat (of which less than 3.5 grams would be saturated fat) and less than 94.5 milligrams of cholesterol per 100 grams. "Extra lean" would refer to cooked meat or poultry with less than 4.9 grams of fat (of which less than 1.8 grams would be saturated fat) and less than 94.5 milligrams of cholesterol per 100 grams. Although the FSIS proposal indicated that these descriptors would apply per 100 grams, the proposal did not clarify that descriptors would also be pertinent to a single serving of the meat or poultry product. That oversight will be corrected in the final rule.

The use of approved descriptors on food labels will encourage producers to produce leaner meat and poultry products.

Compliance

FSIS could sample products in plants, warehouses and retail stores to verify the accuracy of nutrition labeling. (Also see inset, "Backing Up the Nutrition Label.")

Other Issues

One of the issues of deep concern to the regulated industry is economic impact — costs and benefits. FSIS published a preliminary regulatory impact analysis with the November proposal, asking for

Nutrients on the Label

Under the FSIS proposal, the content of 15 basic nutrients, generally recognized as of dietary importance, would be required to be listed on the labels of beef stew, chicken pot pie and other processed meat and poultry products in the mandatory program. (The same nutrients would be listed for FDA-regulated foods under the mandatory program.)

The nutrient profile per serving would be shown. Serving sizes would be listed in metric terms and in common household measurements such as cup, tablespoon, teaspoon, piece, slice. Serving sizes for mandatory nutrition labeling would be based on 131 food categories (including 23 meat and 22 poultry product categories) and "reference amounts."

The 15 basic nutrients to be listed for products in the mandatory program include:

- Calories
- Calories from total fat
- Total fat in grams
- Saturated fat in grams
- Cholesterol in milligrams
- Total carbohydrate in grams, excluding dietary fiber
- Complex carbohydrate in grams
- Sugar in grams (including sugar alcohols)
- Total dietary fiber in grams
- Protein in grams
- Sodium in milligrams
- Vitamin A as Percent of Daily Value*
- Vitamin C as Percent of Daily Value*
- Calcium as Percent of Daily Value*
- Iron as Percent of Daily Value*

Abbreviated Format

If more than eight of the 15 basic nutrients are present only in insignificant amounts — such as 0.2 grams of dietary fiber, which could be rounded to 0 — FSIS and FDA propose using an abbreviated list of nutrients, to include at least:

- Calories
- Total fat
- Total carbohydrates
- Protein
- Sodium

Optional Nutrients

After the content of the basic 15 nutrients have been listed, the FSIS proposal would allow listing of certain other nutrients, or listing of the basic nutrients in additional useful ways. For example, after listing calories from total fat, the label might also list calories from saturated and unsaturated fat, from total carbohydrates and from protein.

Nutrition Claims

Under the FSIS proposal, the label would have to list information about the content of the following nutrients once a claim is made about the nutrient. (This provision would apply to meat and poultry products in the voluntary program, as well as the mandatory program.)

The nutrients include:

- Polyunsaturated and monounsaturated fat in grams, listed separately rather than together as unsaturated fat
- Sugar alcohols
- Soluble and insoluble fiber components
- Protein as Percent of Daily Value*
- Vitamins and minerals not already included in the mandatory list

Voluntary Disclosure

Under the proposal, the following nutrients may be included on the label:

- Calories from saturated and unsaturated fat, total carbohydrates, protein
- Unsaturated fat or polyunsaturated and monounsaturated fats in grams (unless a claim is made about fatty acid or cholesterol content)
- Sugar alcohols declared separately from sugar (unless a claim is made)
- Insoluble and soluble fiber (unless a claim is made)
- Protein in other than infant foods as Percent of Daily Value* (unless a claim is made)
- Potassium in milligrams
- Thiamin, riboflavin, niacin and other vitamins and minerals

* See box on "Percent of Daily Value"

comments and intending to publish a more detailed analysis in 60 days. FSIS is exploring ways to minimize the costs to business.

Another important issue is health messages. Nutrition labeling might be thought of as providing dietary information; health claims go one step further and link this information with specific health benefits. FSIS is concerned that health messages be consistent with the existing state of scientific knowledge and be clearly documented. Therefore, at a later date FSIS will propose health messages requirements for meat and poultry in line with FDA requirements.

On January 30-31, 1992, FDA and FSIS held a joint public meeting to address some of these issues.

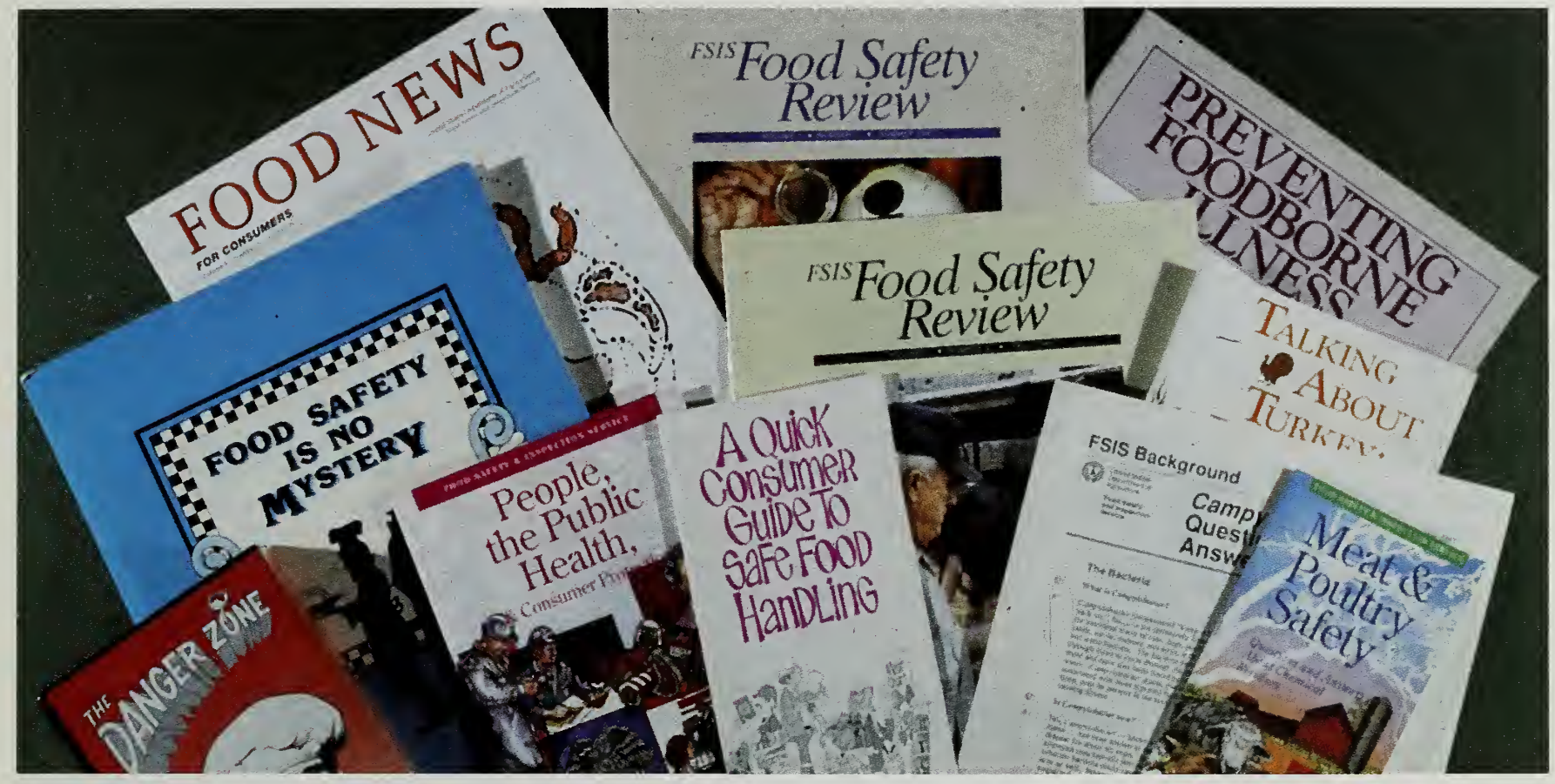
For Further Information

The FSIS proposal and background materials on the nutrition labeling proposals of both FDA and FSIS are available from FSIS Information. To obtain these documents, check the "Nutrition Labeling Proposal" box on the order form with the *FSIS Food Safety Review.*

Upcoming issues of the *FSIS Food Safety Review* will deal with other aspects of nutrition labeling. ◆

Understanding Communication Behavior: A Public Health Imperative

by Dale Blumenthal, MA



FSIS distributes printed, audio and visual food safety materials that are developed to influence the behavior of millions of Americans yearly.

Some scientists and technical experts may think of communication about food safety and handling practices as a one-way process, as information dissemination. So, to enhance public understanding of the scientific process, scientists and technical experts may consider broadening their own understanding of the communication process.

Communication is actually a transaction, an arrangement between the sender and receiver of a message. The involvement of each may vary, depending upon the communication and the circumstances, but the sender and receiver both are parties in completing the transaction.

This view of the communication relationship has prompted modern communicators to change their focus from the classic theory of information diffusion, which postulated that communicators have an unconditional effect on a mass audience "engaged in a collective problem solving behavior" (1).

People seek information when they feel threatened—know those concerns

As Grunig notes, to this theory must be added an appreciation of the "communication behavior of audiences" (2). In order to attract attention to their messages, communicators must appeal to motives and characteristics behind the information-seeking process.

Know the Audience

The audience no longer is regarded as an undifferentiated mass, an easy target for a clean shot of communicator messages. Information theory now includes approaches that examine motivations and experiences that are part of audience members' decisions to watch, read or ignore communications.

As Davison describes:

"The communicator's audience is not a passive recipient—it cannot be regarded as a lump of clay to be molded by the master protagonist. Rather, the audience is made of individuals who demand something from the communications to

People want information from experts and from personal contacts

which they are exposed, and who select those that are likely to be useful to them....Many communicators who have been widely disregarded or misunderstood know that to their cost" (3).

In an effort to design messages that will attract the attention of the receiver, communication researchers must appreciate the importance of the directive, "Know the audience."

Information-Seeking Theories

Many theories exist about information-seeking behavior and the factors that influence receptivity to a message. These theories cover different aspects of the communication process. Some are written with the sender in mind; others are written from the perspective of the receiver. What ties these theories together as a body of literature, however, is that they represent the major work on the motivations behind information seeking and stress the importance of audience research.

Following are principles that emerge from a review of the literature. They are especially relevant for public service and health education programs.

1. Communication that addresses a known problem will be more likely to receive attention, especially if it suggests that one has the ability to change a situation (4).

People select information in order to be prepared or informed about a perceived threat (5).

Therefore, material that is presented in a reassuring manner or that offers a solution is more likely to attract attention and encourage further information seeking than are threatening messages for consumers who are anxious about a health concern (6).

2. By profiling cultural, educational and other psychosocial characteristics of their audience, communicators can more effectively tailor their messages to the group they want to reach.

For instance, those who work in professions or organizations that deal with health information may be especially receptive to health messages. They, therefore, may be an effective target for initiating a public health message (7,8).

3. An important stimulus in information seeking is uncertainty, and an important motive is goal seeking (9,10).

People look to communicators or experts on a subject for the same reasons they look to interpersonal sources to solve a problem (11).

Recognition of human needs and goals in the information-seeking process can encourage attention, and more active information seeking occurs when a message corresponds with the audience's goals and urgency to take action (12,13).

4. Information-seeking costs (money, time, energy and mental ability) must be balanced with the information utility of the message. A person will listen to a message when he or she perceives that its benefits exceed the expectation of expenditures in avoiding it (14).

5. Television appeals to a need for surveillance or satisfaction of curiosity, while print media are associated with specific information and in-depth knowledge and guidance (15,16,17).

However, broadcast and print media work together. As Fedler and Taylor note, persons who have heard a story on the radio or television are more likely to select that story in the newspaper (18).

A radio reporter conducts an interview with an FSIS food safety expert about controlling microbial contamination in meat and poultry.

Make information available, or seeking may cease and anxiety increase

Health Communication Model

The models discussed in the communication literature emphasize that information seeking is a process. One model, described by Lenz, specifically describes health information-seeking behavior (19).

The decision process she outlines involves six steps: stimulus, goal-setting, decision whether to actively seek information, search behavior, information acquisition and codification and decision regarding the adequacy of the information required.

A stimulus may come either from inside the person (such as the experience of symptoms) or outside (such as negative comments from friends about health habits). It signals a discrepancy between information possessed and needed by initiating a "call to action." In goal-setting, the immediacy with which information is required often negatively relates to the extent of the search.

Factors that influence the decision about whether to launch an active search for information include the amount of relevant prior information and the anticipated cost-benefit ratio. Potential benefits, says Lenz, may be the "reduction of anxiety and uncertainty and an increased sense of mastery or control."

The next step, search behavior, is a multi-faceted process. Lenz distinguishes between an impersonal method, in which information is sought either from an inanimate source (such as a publication) or a personal source (an expert or consultant). She says that "health professionals may fail to acknowledge the value of personal information sources to clients."

In discussing personal sources, Lenz notes that "studies of information search and dissemination have shown that there is a tendency for those with only weak ties to the searcher....to possess information the searcher does not already have" because their networks are less likely to overlap.

In the information acquisition step, new and relevant information is added to memory and may encourage further search behavior. Lenz suggests that a pattern of cycling between memory-based information and seeking new information may exist.

In the decision point on information adequacy, Lenz finds that "fatigue, boredom, frustration, urgency to take action, and difficulty in extracting information from sources may encourage 'premature' termination of the search—whereas curiosity, interest, knowledgeable and willing consultants, and strict adherence of predefined goals encourage continuation."

The dynamics expressed in this model and in the major communication theories underline the importance of understanding the audience. Public perception of need often initiates information-seeking activity. And the public turns to experts, or consultants, for the information they lack.

Food safety researchers may take these insights and use them to their advantage. Scientific advances do not occur in the confines of the laboratory. They acquire meaning in the world of public health only when they are communicated to the public.

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What Do Consumers Know About Food Safety?

by Robert Gravani, PhD;
Donna Williamson, MS;
and Dale Blumenthal, MA

In a recent study, FSIS estimated that safe food handling practices could have prevented at least 25 percent of reported foodborne illness outbreaks (1). FSIS has since cooperated with Cornell University researchers Donna Williamson, MS, and Robert Gravani, Ph.D., to explore what consumers know and don't know about food safety and to identify groups most lacking in food safety information.

Gravani and Williamson developed a nationwide consumer survey on home food preparation practices (2), and sent the questionnaire to 2,005 randomly selected households. The goal was to help food professionals plan effective food safety education programs and publications.

The Survey

Forty-nine questions targeted six major research objectives:

1. To determine consumer knowledge of key home food safety terms and concepts;
2. To obtain information on consumer home food preparation practices;
3. To identify consumer perceptions about home food safety issues;
4. To determine whether consumer food safety knowledge can be correlated with proper home food preparation practices;
5. To assess consumer confidence in sources of food safety information and the best method for providing future information;
6. To identify the groups of consumers who would benefit from additional food safety information.

The mailing generated 869 completed and returned surveys, and, after "bad addresses" and other factors were accounted for, the overall response rate was 49.7 percent.

This article will address important findings on knowledge of food safety and preparation and on directions for public health communication on food safety.

Food Safety

In the area of food safety knowledge, 59 percent of respondents answered "No" to the question: "Are there foods you avoid because you are concerned about foodborne illness?" This response suggested to the researchers that many consumers may be unaware of potential foodborne diseases and foods commonly associated with them.

Although 93 percent of respondents would be concerned about raw meat left at room temperature for over four hours, only 82 percent of these same respondents would be concerned about cooked meat left out for the same amount of time. The researchers noted that some consumers may not be aware of the dangers of recontamination.

The accompanying table (see Table 1) shows the survey results of questions in which respondents were asked to indicate their level of agreement with a particular statement.

Twenty-four percent of respondents agreed with the statement that "you can always tell when a food will cause foodborne illness because it will smell or taste bad," and an additional 8 percent were not sure. Consumers may not understand that a food may contain pathogenic bacteria even if it does not smell, taste or look bad.

Twenty-eight percent of respondents did not know that freezing does not kill all harmful bacteria, and 14 percent did not know that bacteria grow rapidly at room temperature.

Dr. Gravani is professor of food science at Cornell University in Ithaca, N.Y. Donna Williamson is a food scientist and Captain in the U.S. Army, stationed in Fort Lee, Va. Dale Blumenthal is a science writer on the FSIS staff.

Table 1

In Question 33 of the survey, Williamson investigated consumers' level of certainty about various food safety concerns:

Below are several options with which some people agree and others disagree. Please indicate how much you agree or disagree with each statement.

	STRONGLY DISAGREE Valid percent	**DISAGREE** Valid percent	**NOT SURE** Valid percent	**AGREE** Valid percent	**STRONGLY AGREE** Valid percent
1) You can always tell when a food will cause illness because it will smell or taste bad.	33.1	34.5	8.4	13.7	10.0
2) To maintain food safely, refrigerators should be set at 38-40 degrees F.	2.5	9.8	29.6	50.4	7.6
3) Freezing foods kills all bacteria that may cause illness.	23.8	48.2	19.8	7.0	1.2
4) Refrigeration completely stops the growth of harmful bacteria.	33.3	47.4	13.1	5.3	1.1
5) Bacteria that cause foodborne disease grow rapidly at room temperature.	2.0	1.4	10.5	60.3	25.9
6) Foodborne disease such as *Salmonella* can be serious enough to cause death.	1.9	1.9	15.3	47.9	33.1

Thirty-three percent of respondents were not familiar with the term *Staphylococcus;* 26 percent did not know that *Salmonella* is most likely associated with raw poultry and eggs; 24 percent did not know the term trichinosis; and 31 percent did not know that botulism can be associated with improperly processed canned foods.

...and Preparation

One question included a series of instances when handwashing with soap and water would be important to prevent the spread of bacteria: Seventeen percent of respondents would not wash after handling raw chicken and 14 percent after sneezing. As respondents might have assumed that handwashing after touching raw meat or after sneezing was the "correct" answer, it is likely that more consumers than this survey reflects do not follow proper hygiene procedures.

Cross-contamination, or the spread of bacteria from one food to another, is a major food safety concern that consumers can control at the preparation stage. Touching uncontaminated food with utensils or hands that have touched contaminated food is a common cause of cross-contamination. Yet, after cutting fresh meat, only 53.6 percent of respondents indicated they would follow the safest procedure of washing the knife and cutting board with soap and water before chopping vegetables.

Inadequate internal temperature of cooked meat and poultry is another major food safety risk that occurs in preparation and that consumers can prevent. Yet, only 27 percent of respondents used a thermometer in cooking meat; 28 percent for poultry. Although 11 percent said they used meat products with a pop-up thermometer and 44 percent used poultry products with a pop-up thermometer, the survey results indicate that education is needed on proper use of thermometers to ensure that food is thoroughly cooked.

Cooling and Thawing

The survey also indicated lack of knowledge about cooling procedures. Fifty-four percent of respondents would store leftover stew in a deep container, and another 14 percent in the pot in which it was cooked. Only 32 percent knew to store leftovers in a shallow container.

Twenty-three percent of respondents said they would thaw hamburger meat on the countertop at room temperature.

Food Safety Perceptions

Findings from responses to questions regarding food safety perceptions revealed changes in beliefs that researchers concluded may testify to the effectiveness of recent food safety education efforts.

For example, the home was ranked third (16 percent of respondents) out of six choices as the place where food safety risks are most likely to occur. In a 1985 study, however, homes were ranked as the least likely place (3). Food manufacturing facilities were ranked first in both studies, although epidemiological data indicate restaurants, institutions and other large preparation facilities are far more likely to be the site of mistakes that lead to foodborne illness.

In an open-ended question, 14 percent of respondents listed pesticides as their top food safety concern—fourth highest in a list of eight choices. The researchers were quick to note that in the 1991 Food Marketing Trends survey, pesticides were listed by respondents (20 percent) as the second greatest food safety threat (4).

Future Directions

In exploring sources of food safety information, researchers learned that the sources ranked highest as "reliable" or "very reliable" by respondents were newspapers, magazines and health professionals (75 percent for each).

Yet, television was considered "the most convenient" way to obtain food safety information (33 percent), followed by newspapers and magazines. Health professionals were ranked fourth (with 4 percent), along with food manufacturers and pamphlets in supermarkets.

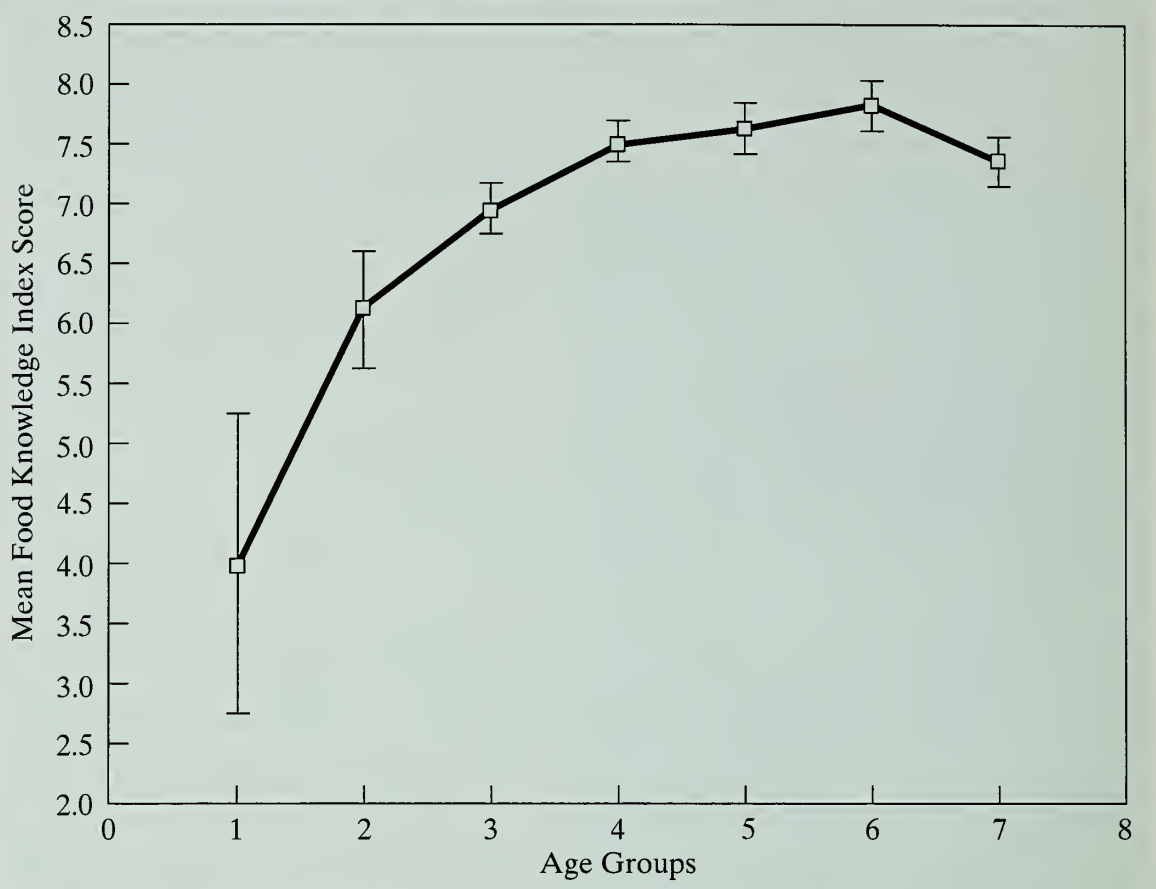
These results indicate that food professionals need to be proactive in working with media to disseminate accurate information about food safety issues, concludes Williamson. "By developing a good working relationship with media contacts, food professionals will be sought out as credible and knowledgeable sources of useful information," she says. Food professionals have an important role to play in encouraging use of well documented and accurate information in news reports.

The Cornell research study, as well as other consumer research projects, offers insights for effective communication. For instance, before designing publications and video features on food safety, FSIS carefully identifies the target audience for materials. The agency pretests booklets and videos before final production to determine whether the target audience is receptive to the messages and the ways they are presented.

One valuable resource for FSIS in understanding the public's needs is USDA's Tollfree Meat and Poultry Hotline, which consumers can call with their questions about food safety (5). The phone number is 1-800-535-4555. FSIS regularly reviews the public concerns most commonly expressed.

By combining their expertise on food safety issues with an understanding of what people need and want, food scientists can provide a unique public health service.

Food Safety Knowledge Index



Legend:

1 = less than 18 years;
2 = 18-24 years;
3 = 25-34 years;
4 = 35-44 years;
5 = 45-54 years;
6 = 55-64 years;
7 = 65 or more years

The Cornell researchers recoded responses to 11 key questions about food safety and preparation to reflect a correct or incorrect response. A food safety knowledge index score was then calculated, and the mean scores were cross-tabulated with age, gender and education variables.

Mean index scores increased as age increased to 65, and then decreased slightly for the over-65 age group. Age groups under 35 scored the lowest (see above chart), and females had a slightly higher mean score than males. Mean index scores increased with education up to the associate degree level, but decreased for college graduates and those with advanced degrees.

Among their recommendations, the researchers advised that consumers age 35 and younger should be a key target group for food safety education efforts.

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Ozone Considered As Disinfectant Agent

by Jacque Lee, BA
FSIS Science Writer

A new ozone-gas treatment to disinfect recycled chiller water in poultry slaughter plants is under review by the Food Safety and Inspection Service.

"The new ozonation process will result in chiller water that is twice as clean. In fact, ozone-treated water approaches potable water in quality," says Dr. Michael Rose, deputy director in the Facilities, Equipment and Sanitation Division of the FSIS Science and Technology Program.

According to Dr. Rose, the new system disinfects water for reuse by reducing organic matter and bacteria. It improves the chemical, physical and microbial quality of the chill tank because water is being constantly treated throughout the process.

"In addition to improving the quality of water in the chill tank, the ozonation process will help the poultry industry to conserve water, something important to all Americans," said Dr. Rose.

In the new process, ozone gas is produced by passing an electric current through air, changing oxygen molecules to ozone molecules. The quick action of the reactive ozone gas oxidizes organic molecules in chiller water by breaking carbon-to-carbon bonds. Called "ozonation," the process kills bacteria and results in simpler organic molecules.

FSIS requires that poultry be cooled to 40 degrees F or below at the end of the slaughter process and before packing, except when the packaging will be followed immediately by freezing at the official establishment. In addition to

Chiller water is shown before and after ozonation.

continuously fed chiller water tank systems, which usually utilize chlorine for disinfection purposes, other chilling processes in current use include an air chill system and the static tank method in which chill tanks contain slush ice.

Agency Evaluations

Dr. Rose says the prototype of the "ozonation" system was evaluated in a turkey processing plant by FSIS in cooperation with the Food Safety Consortium. The agency will also test the process under full-scale production conditions in a chicken slaughter plant. If that evaluation meets FSIS standards, the agency plans to issue guidelines for installation, materials and proper use of ozone equipment by other slaughter plants.

FSIS rule 9CFR 381.66(C)(2)(VI), pertaining to reconditioning of chiller water, states that any owner or operator of an officially approved establishment may submit data to show that a proposed new system meets certain criteria. FSIS then evaluates the system to determine whether a reduction in fresh water intakes will be permitted.

Current standards are as follows:

Minimum Percent reduction of micro-organisms in treated water	Minimum Percent light transmission in treated water	Gallons of reconditioned water to replace one gallon of fresh water
60	60	1.75
70	70	1.50
80	80	1.35
90	80	1.25
98	80	1.10

Criteria that determine whether water reconditioned by ozonation is suitable for return to the chilling operation may include the following:

—-Total plate count less than 1,000 organisms per milliliter.
—-Coliforms less than 10 per milliliter.
—-*Escherichia coli* less than two per milliliter.
—-Total organic carbon less than 100 milligrams per liter.
—-At least 90 percent light transfer.

The Ozonation Process

To start the ozonation process, water begins passage through a "cleaning mode," passing from the chiller tank to a high powered water rinse or hydrasieve. From the sieve, the water goes through a separation tank to further reduce the amount of remaining solids. Continuing through a water flow valve with a maximum flow limit, the water enters the first of four tanks into which ozone gas is injected through pipes from a generator located outside the slaughter plant building. Consistent with FSIS rules, as with chlorination, the gas source would have to be outside the actual premises.

At the top of each of the four inside tanks, particulate matter is removed.

Carbon Filters

After ozone treatment, water is pumped through activated carbon filters. It is then sampled to determine if the water meets chemical, physical and microbial standards set by FSIS.

If the water qualifies for reuse as fresh water, it begins a return trip to the chiller tank intake.

Ozonated water in the new process will be routinely monitored for light transmittance level. A solenoid switch will trigger an alarm and turn off the system if the light transmittance is less than the specified 90 percent. If the water does not transmit light well, this would indicate the presence of organic matter and a possible problem with the system.

Ozone and Water Flow

Dr. Rose says ozone purification of chiller water will make it possible to maintain more uniform levels of water

cleanliness than are possible under current methods.

According to Dr. Rose, the chemical and microbial quality of poultry coming into the plants varies widely from flock to flock, day to day and season to season. By making it possible to use more purified water in the chilling process, ozonation will help reduce microbial growth.

Chlorine Use

Chlorine is used to disinfect chiller water tanks in the majority of the 283 U.S. poultry slaughter plants, according to a recent FSIS survey. The chemical is not used in the few plants that still use the air chilling method, in the static tank method, or in kosher slaughter.

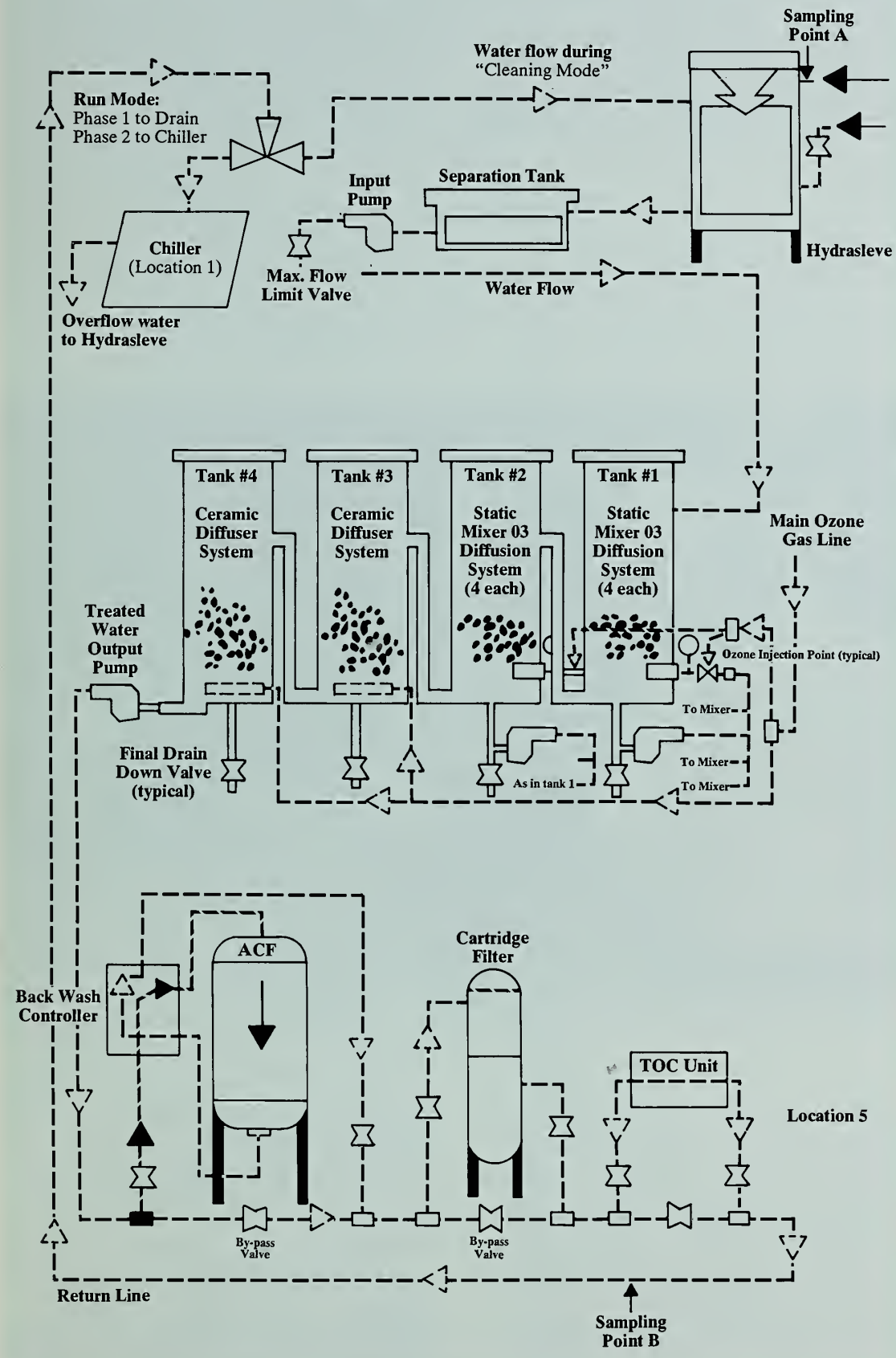
If plants choose to use chlorine, FSIS rules stipulate that there be between 20 and 50 parts per million residual chlorine in the fresh water intake in the first section of a chilling system.

Chlorine is currently the most efficient control for water cleanliness approved for use in the poultry slaughter process, says Dr. Rose.

Chlorinated water is added to chiller water tanks to replace water lost as spillage (limited by regulation), through evaporation, and by absorption. FSIS estimates that carcasses carry off 8 to 12 percent of chiller water and that spillage accounts for a 15 percent loss. Remaining chlorinated tank water is discharged without reuse at the end of an operating day.

Although approved chlorine levels have been established, the hunt has been

AWPI
Water Re-Circulation System
Ozone and Water Flow Diagram



on for years for a more efficient and less expensive method to improve the quality of chiller water. There has also been widespread environmental concern about the discharge of chlorine-treated effluents from chiller tanks and their effect upon underground water tables near slaughter plants.

Water Supply

Water is a precious commodity and becoming even more so. Dr. Rose reports that the cost of water for poultry slaughter plants has risen by a factor of 10 in each of the last three decades. From about two cents per 100 gallons in 1960, the cost to some plants is now about $2 for the same amount and could reach $20 per 100 gallons by the year 2000.

According to the FSIS rule for continuous chilling systems, the fresh water intake in the first section of a system, after all systems have been filled with water, cannot be less than one-half gallon per frying chicken. Intake must increase proportionately more for other classes of poultry, including not less than one gallon per turkey.

Although industry has been able to reduce consumer prices for poultry during the past 50 years, increased production costs to meet added food safety criteria and due to water shortages could eventually result in much higher retail prices.

In the initial pilot test, ozonation for chiller water reuse saved both energy and water costs. Operators estimated a daily net savings of $200 per day in the 60-turkey-per-minute chilling operation.

Developers of the system tested by FSIS estimated that installation costs could be recovered within three years.

Dr. Rose points out that the role of FSIS in approving any sanitation practice or new method in processing is twofold: First, the agency must determine whether a newly proposed system is safe, and, second, the agency must determine whether the new system is efficacious.

"We test a proposal and if the process is safe and the equipment works, the equipment will go on our list of approved equipment. It is up to industry to decide to retool," says Dr. Rose. ◆

New Checks for Escherichia coli

by Dr. Paul A. Hartman, PhD
Department of Microbiology
Iowa State University

If food samples were examined for the presence of all possible enteric pathogens, the cost would be prohibitive, and the effort still would not eliminate all risks. Therefore, the concept of using an indicator organism was originated.

One of the most common indicators is the coliform group of bacteria. The coliform group, however, includes many organisms commonly found in nature in plant material and soil, as well as in animal sources. *E. coli* is one coliform that is more often found in and on warm blooded animals such as food animals or humans. This makes it a useful indicator of meat or poultry hygiene.

However, until 1982, the time and expense needed to isolate and identify *E. coli* discouraged the use of this species-specific contamination indicator in food microbiology.

In 1982, Feng and Hartman (7) described procedures for the simultaneous determination of both total coliforms and *E. coli* in food and water samples. This was accomplished by adding a fluorogenic substrate, 4-methylumbelliferyl-b-D-glucuronide (MUG), to media commonly used for total coliform determinations.

Editor's Note: The Food Safety and Inspection Service is cooperating with scientists in the Food Safety Consortium, established by Congress in 1988 to conduct meat and poultry research. Iowa State University is a member of the Consortium, along with the University of Arkansas and Kansas State University.

Dr. Paul Hartman of the Food Safety Consortium conducts a rapid latex agglutination test to confirm the presence of E. coli.

Among the *Enterobacteriaceae,* about 94 percent of clinical and environmental isolates of *E. coli,* 44 percent of shigellae, and 20 percent of salmonellae produce an enzyme, glucuronidase (GUD) (10). GUD hydrolyzes MUG, which is not fluorescent. A product, 4-methylumbelliferone (4-MU), is released.

4-MU exhibits a bright blue fluorescence when exposed to long-wave ultraviolet light. Other members of the *Enterobacteriaceae* hydrolyze MUG infrequently, and when salmonellae and shigellae are encountered in food samples, they are usually found in low numbers. Therefore, the presence of *E. coli* may be assumed when a positive MUG reaction is obtained.

Various modifications of these procedures have been widely accepted for food analyses (11,12).

Although the MUG test is widely used to screen raw materials and finished products for the presence of *E. coli,* shortcomings have been observed. Hemorrhagic colitis strains of *E. coli* (mostly of the serotype 0157:H7) do not give a positive MUG test and are not detected (10).

In addition, the ability to hydrolyze MUG varies considerably among *E. coli* strains, depending on the source. MUG-

negative strains can constitute up to 30 percent of those isolated from fecal samples (2,9).

When a MUG-containing medium (5,6) was compared with the membrane filtration fecal coliform test using water samples, correlations were only 46 percent with reservoir and 70 percent with influent samples (3); another MUG-containing medium (14) performed better; correlations were 71 percent with reservoir and 89 percent with influent samples.

Covert et al. (4) and Lewis and Mak (14) reported that substantial proportions of tubes that contained *E. coli* did not display a positive MUG reaction. That MUG tests fail to detect the presence of many *E. coli* is a public health concern.

The results of recent studies (1,8) showed that almost all MUG-negative strains of *E. coli* possess a gene-encoding GUD. The reason these strains are MUG-negative is unknown.

Several explanations are that the GUD gene is not expressed, MUG cannot penetrate the cells of certain *E. coli* strains, or an inactive GUD is produced.

The latter two possibilities seem most likely because Kasper et al. (13) obtained positive reactions with anti-GUD antibody in five of six MUG-negative *E. coli* tested. Their results indicated that a simple, rapid test that would detect MUG-negative *E. coli* could be devised.

Under the auspices of a USDA-Cooperative State Research Service (CSRS) grant to Iowa State University, a rapid latex agglutination test to confirm the presence of *E. coli* is being developed by the author and Mark J. Wolcott.

In this test, antibodies to enzymes specific to *E. coli* GUD, glutamic acid decarboxylase (GAD) and tryptophanase will be coated on latex beads. If *E. coli* is present in a culture medium, the antibodies on the latex particles will bind to the *E. coli* enzymes.

Agglutination (clumping) of the latex particles will occur within 15 minutes.

At present, GUD can be detected at 0.003 mg/ml and tryptophanase at 0.001 mg/ml. Some cross-reactivity is being obtained with anti-GUD antibodies, and studies are in progress to address this problem.

Various antibody preparation methods are being studied, including purification by using protein A columns (elution with acid or chaotropic releasing agents), enzyme-affinity columns, and DEAE (diethyl-amino-ethyl) chromatography. When reagent preparation and test conditions are optimized, a method will be available to detect at least 98 percent of the *E. coli* in test samples.

Rapid confirmatory tests such as that described above will further increase the safety of our food and water supplies by increasing the reliability of *E. coli* detection.

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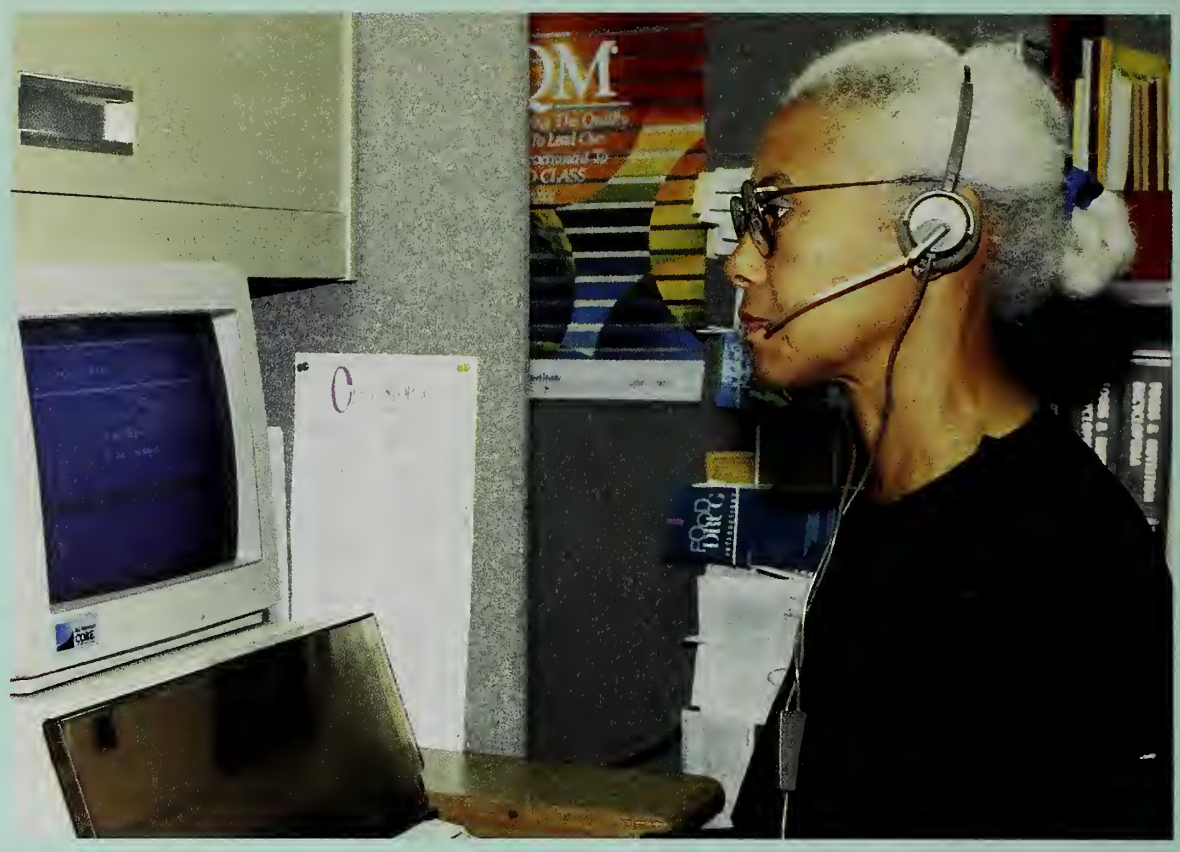

Nearly 300,000 consumers have called the FSIS Poultry Hotline since it was established in 1985 to provide the public with answers to questions about food safety. *Stories, page 9 and 12.*

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